East Anglian Li...

JAN 10 1944

FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 71. No. 1425. DECEMBER 9, 1943

Registered at the G.P.O. as a Newspaper. Offices: 49, Wellington Street, Strand, London, W.C.2

Single Copy 6d. By Post 8d
Annual Subscription, Home and Overseas, 21/-(Prepaid)

ITISH
OULDING
ACHINE Co. LTD.
VERSHAM, KENT

"MARCO" SAND PREPARATION and MECHANICAL HANDLING PLANT
MARCO CONVEYOR & ENGINEERING CO. LTD.
Rowin Works, Lynn Road, Leytonstone.
Telephone: LONDON, E.11 Telegrams: Engimarco, Leystone
Leytonstone 2254/5.
Midland Representative: Mr. G. H. TAYLOR,
36, Bennets Hill, Birmingham, 2.
Telephone Central 2917

JOHN A. SMEETON LTD.
76, Auckland Rd., London, S.E.19
COLLIN' IMFROVED FOUNDRY LADLES
'PERFECT' CHILLING SPIRALS
MANUFACTURED IN GREAT BRITAIN
Smeatolim, Westnor, London LIV 2925

MANSFIELD
Moulding Sand
ALBION (Mansfield) SAND CO.

LDAYS & ONIONS LTD.
BIRMINGHAM 11
N & STEEL FOUNDRY PLANTS

TEISEN
ENAMELLING MUFFLES.
KING'S NORTON, BIRMINGHAM

How are YOU tackling this labour problem?

Loading, unloading and handling of loose or bulk materials without mechanical aid involves a serious waste of labour—to say nothing of lost time for wagons. This practical Loader is tackling the problem—saving a substantial part of previous time and labour—for a large number of different industries handling such materials as Coal, Coke, Sand, Pig Iron, Scrap, etc. How are YOU tackling this vital problem?

Why not put your material where it is wanted in the minimum time with the minimum labour? Write us now for details.

PARKER Portable Belt LOADERS

FREDERICK PARKER LTD. (Extension 12), VIADUCT WORKS, CATHERINE ST. 'Phone : Leicester 61273 (4 lines) **LEICESTER**

London Office: (Extension 12), TALBOT HOUSE, ARUNDEL STREET, STRAND, W.C.2. 'Phone : 4239 & 2739 Temple Bar, London

Holman

SPECIALISTS IN PNEUMATIC EQUIPMENT FOR PRODUCTION AND MAINTENANCE

Holman BROS. LTD.
CAMBORNE - - - ENGLAND

'PHONE : CAMBORNE 2275 (4 lines) 'GRAMS : "AIRDRILL — CAMBORNE"

FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 71 Thursday, December 9, 1943 No. 1425

Guiding Principles

According to a Memorandum issued by the Royal Statistical Society, the war has brought about a change in the attitude of the British public towards statistics. "In pre-war days," we are informed, "the average citizen's attitude was that of one of O'Henry's characters who defined it as 'the lowest form of information known to exist'." Surely this is a one-sided view, and the truth is that statistics are not merely acceptable, but are cherished if they relate to subjects wherein a major interest reposes. It is when the purpose of their collection is unknown or nebulous, that acute boredom becomes evident. In these cases the record high and low may arouse passing interest, if garnished by banner headlines. Stories we have published as to the largest and smallest casting ever made, which to carry conviction must be the outcome of the collection of statistics, invariably create widespread interest, embracing as they do reliability of the source, and technicalities. In the foundry industry there has been made available during the last two decades a wealth of statistical matter of a technical character, associated with a poverty of reliable data covering commercial activities, due to the complex make-up of the industry. Consequent upon wartime requirements, the prosecution of essential technical processes has necessitated the filling up of innumerable statistical forms of a commercial character for control purposes. With this has come a realisation that for the proper conduct of an industry, statistics, akin to the type now being assembled, must be made available in peacetime. Moreover, their presentation must be accompanied by enlightened interpretation to arouse and maintain interest. Here, for instance, we are attempting to convey commercial information extracted from a purely technical Paper on "Cupola-Electric Furnace Duplexing of Malleable Iron," by Mr. Charles Morrison, of Saginaw, Michigan. The foundry in which his experiments were carried out—the Saginaw Malleable Iron Division of General Motors Corporation—melts 5,000 tons a week. This is done by two pairs of 30-ton per hr. cupolas working on alternate days. For the control of this huge output the management have found that it pays to heat up the cupola blast externally to 300 deg. F., and to install apparatus to ensure that the moisture content remains constant at 4.2 grains per cub. ft. of blast. Moreover, in order to ensure that the metallurgical conditions—*id est*, composition and casting temperature do not vary—two electric furnaces of 30 tons per hr. when duplexing are considered necessary. All this is done because the extensive research work the company has undertaken has convinced its management that the raw materials of our industry do possess, for good or evil, transmittable inherent properties. Only by control, based on statistical proof, can a high grade product be consistently produced. The lesson to be deduced from this is that as a foundry concern assumes sizeable dimensions, it can no longer rely on the inherent skill of the employees to direct into useful channels the inherent properties of the raw materials, but must rely on statistics derived from their own or other peoples' scientifically controlled practice for the proper conduct of their business.

INSTITUTE OF BRITISH FOUNDRYMEN

The Acting Secretary of the Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, is desirous of communicating with the following members and associate members, as mail is being returned from their last known addresses:—

Mr. S. Simpson (Newcastle Branch); Mr. W. Syme (London Branch); Mr. S. Wade (W.R.Y. Branch); and Mr. H. Bennett (Newcastle Branch).

Contents

Guiding Principles, 281.—Institute of British Foundrymen, 281.—Notes from the Branches, 282.—Publications Received, 282.—High-Si Acid-Resisting Cast Iron, 283.—Staff Colleges for Technicians, 289.—Standard Pattern Colours, 289.—Heat-Treatment by Induction, 290.—Iscor's Largest Steel Ingot, 290.—Book Review, 290.—Notes on Oil-Sand Practice in the Ordinary Foundry, 291.—Sand Adhering to the Surface of Castings, 294.—New Patents, 294.—New Trade Marks, 294.—News in Brief, 296.—Obituary, 296.—Parliamentary Notes, 298.—Canadian Iron and Steel Industry, 298.—Personal, 298.—Company Results, 300.—New Companies, 300.—Raw Material Markets, 302.—Control of Measuring Instruments, 302.

Raw Material Markets

IRON AND STEEL

The last remaining month of the current year will be fully occupied in the completion of expiring contracts, and already steel producers have entered into substantial commitments for 1944. The emphasis of demand changes from time to time, but the aggregate tonnages required are kept at a high level and the present indications are that works will be fully employed in the coming year in catering for the heavy and varied needs of the war industries.

Purchase of any grade of pig-iron is only permissible under licence; but for approved purposes these licences are readily obtainable and supplies are abundant. Even the makers of low- and medium-phosphorus iron, which a few weeks ago was distinctly scarce, are now seeking orders, and refined iron is also on offer. To some extent the easier conditions are due to the acceleration of the intake of foreign ores and the stimulating influence on the production of quality pig-iron. But the reduced activity at some of the foundries is also a contributory cause. The light-castings trade is distinctly dull and there are ample supplies of high-phosphorus iron available, but hematite is keenly sought and the meagre tonnages released by the Control leave a big unsatisfied demand. There are still large stocks of coke on the ground in Durham and all the fuel requirements of the blast furnaces are fully met, while the output of limestone also keeps pace with current needs.

The scrap trade has been asked to increase deliveries over the remainder of the year, but there is, at present, no real difficulty with respect to either steel or cast-iron scrap, although certainly the position has been tightening up a little recently. A better demand has developed for ferro-alloys, but foundries have no difficulty in getting the grades they want.

The principal difficulty which is at present encountered concerning the maintenance of adequate deliveries of steel semis to the re-rolling plants is the occasional shortage of wagons, and a special appeal has been issued to achieve a quicker turn-round of empty trucks. This, of course, is no new phase of rail transport problems, but, in the existing circumstances, the importance of speedier loading and unloading has acquired greater urgency. The steelworks are regularly providing the weekly quotas of blooms, billets, and sheet bars, and, in addition, good use is being made of seconds, crops and other re-rollable material.

Some of the heavy sheet mills are still engaged in augmenting the output of steel plates for shipbuilding and other purposes, and without their help it would be impossible to keep pace with a demand which is almost insatiable. By a careful supervision of distribution the Control has hitherto avoided serious interruptions in essential war industries and the system of allocations has been assisted by the now general practice of specifying requirements many months in advance of required delivery dates. Sectional material, especially light and medium sizes, is also in brisk demand, but the arrears of deliveries are not so extensive as for plates and it is possible to get heavy sizes at short notice. All gauges of sheets are booked for months ahead and the collieries are pressing for increased quotas of roofing material.

A brisk demand has developed for finished iron, particularly the light sizes, and it has become difficult to place further orders for execution before the end of the year.

NON-FERROUS METALS

There is evidence that the total consumption of copper, lead and zinc is below the peak levels reached last year and early in 1943, and though absorption of these metals is still on a very large scale indeed, all essential needs are being readily met. How soon it will be possible to manufacture metal articles for home use and for export is another matter, but it is not without the realms of possibility that something along these lines will be possible before very long. The light metals perhaps are in another category. Although the production of aluminium, for example, has been greatly increased since the war, every ton which becomes available is needed by the aircraft producers and other essential users. Meanwhile, the attitude of the Control is unchanged no matter what the current supply position may be in particular metal; licences to acquire are not issued unless the need for the metal for war or important home purposes is proved. Consumption of tin, of course, has been reduced by force of circumstances, but users can still get supplies for essential purposes.

Webcoline!
The LEADER of
ROTARY FURNACE
Refractory Linings
WRITE FOR PRICE AND FULL PARTICULARS.
WEBSTER & Co. (Sheffield), Ltd., Millhouses, Sheffield 8.
MAKERS OF HIGH GRADE REFRACTORIES. Telephone: Sheffield 71071

NOTES FROM THE BRANCHES

BIRMINGHAM, COVENTRY AND WEST MIDLANDS

Mr. Frank Hudson, convener of the Non-Ferrous Committee which has been investigating defects in castings, attended a meeting of this Branch on November 27, when he gave a brief account of the work, and asked for comments on the pictures, shown to illustrate typical defects. The prevalence of influenza kept several members at home, including the Branch-President, Mr. J. J. Sheehan, and the Hon. Secretary, Mr. A. A. Timmins. In the circumstances Mr. G. R. Shotton, the Senior Vice-President, occupied the chair. He took the opportunity of welcoming Mr. Tom Makemson, General Secretary of the Institute, who was among those present.

Mr. Hudson explained that he had not come to give a lecture in the accepted meaning of the term. Rather, it was his purpose to outline what was being done at the present time by the Non-Ferrous Sub-Committee, and to ask for the co-operation of members of the Branch in connection with the work. The idea some twelve months ago, he said, was to get together a collection of good pictures showing typical examples of defects in non-ferrous castings which could be used by practical foundrymen as a means of reference. It was decided to concentrate as far as possible on the actual photographs, the impression being that one picture said more than thousands of words, and to keep the text to the minimum, covering only such necessities as classification of defect, cause, and method of correction. Ultimately, it was decided to cover defects in various metals, such as iron and steel, and work was now proceeding in that direction also. So far as the non-ferrous part was concerned, a fairly comprehensive collection of photographs had been obtained, and these were now being classified. The Non-Ferrous Sub-Committee felt, however, that it was particularly important that no mistakes should be made, and was anxious to have the comments of members of the Institute on the work before it was published. He proposed to throw slides on the screen and to ask the meeting to discuss them individually. If members did not agree with the Sub-Committee's views, he would like them to say so. Respecting each slide he would ask them (1) whether they agreed with the classification of the defect; (2) had they any causes to suggest other than those mentioned, and (3) had they any methods of correction to put forward other than those enumerated.

Proposing a vote of thanks to Mr. Hudson, Mr. A. Tipper said he thought they had all gained something by seeing the photographs. Speaking for himself, he was very much alive to the need of an atlas of the kind proposed, in which he hoped there would be a section dealing with sand defects in relation to all the metals to be illustrated. He urged that the atlas should be as comprehensive as possible, covering steel, malleable iron, grey iron, non-ferrous metals, copper alloys and light alloys, and giving as much information as possible on the defects. If Mr. Hudson, in his capacity as convener of the Non-Ferrous Sub-Committee, did nothing else than complete the atlas in the non-ferrous section, he felt that the work would have been well worth his time and energy.

Mr. T. H. Gameson, who seconded the motion, said that as one who had had nothing at all to do with the preparation of the atlas, he thought it was likely to be a most valuable piece of work. On the whole, the photographs seemed to him to be excellent. What the effect of the atlas would be upon engineers—whether they would think that the foundry group were doing an immensely difficult job, or that they were more hopeless than ever—he did not know.

The vote of thanks was heartily endorsed by the meeting.

There was some further discussion, in the course of which a suggestion was made that the castings illustrated should be retained for examination in the light of comments made at Branch meetings.

Acknowledging the thanks of the meeting, Mr. Hudson said he could not retain the castings because he had not got them. He added that he was rather sorry in some respects that they had been beaten in this matter by the U.S.A. The "American Foundryman" gave an outline of what had been done in that country.

The Chairman announced that the next meeting of the Branch would be on March 24.

PUBLICATIONS RECEIVED

The First Five Years. Published by the British Coal Utilisation Research Association, Rickett Street, West Brompton, London, S.W.6.

This 28-page brochure is produced on pre-war standards, and makes a welcome change from the austere character of contemporary literature of this type now being received. Yet, by compression, all the information disclosed could have been attractively covered in a booklet half the size, especially as the ground has previously been dealt with in annual Reports.

Colloidal Clays. American Colloid Company.

We have received from I.C.I. (Paints), Limited, Alma Street, Smethwick, Birmingham, a series of seven bulletins issued by the American Colloid Company, carrying the caption "Volclay Bentonite News Letter." These bulletins each contain a message of real interest to the practical foundryman, couched in terms so striking that they compel attention. For instance, when dealing with the moisture content of moulding sands, it is pointed out that a 400-lb. mould will give off 80 cub. ft. of steam when subjected to high heat.

Campbell, Wyant & Cannon Foundry Company, one of the best-known American foundries, has installed a million-volt X-ray unit. It is capable of penetrating 8 in. of steel at a distance of 3 ft. with an exposure of about 210 milliampere minutes. Amongst the castings controlled are 12-ft. 10-throw cast crankshafts weighing about a ton, and 20 ft. long 8-throw shafts weighing nearly 5 tons.

HIGH-SI ACID-RESISTING CAST IRON*

By J. E. HURST, D.Met.

Corrosion Resistance — Mechanical and Physical Properties — Effects of Carbon, Gas Content and Temperature —Annealing and Welding

It is well established that alloys of iron and silicon containing upwards of 14 per cent. silicon possess very great resistance to the corrosive attack of the mineral acids. Because of these excellent corrosion-resisting properties these alloys find a use in the chemical industry where resistance to strongly corrosive liquids coupled with metallic properties is essential. These alloys are manufactured and sold under a variety of trade names, but are all embraced in the phrase "high-silicon acid-resisting cast iron," the title of this Paper.

Corrosion Resistance

The corrosion resistance of alloys of iron and silicon in contact with boiling 20 per cent. sulphuric acid is illustrated by Fig. 1. The rate of corrosion is expressed in millimetres of acid penetration per year, and it will be observed that the magnitude of acid attack decreases rapidly with increasing silicon content. Above a value of 14.25 per cent. further increases in silicon do not result in a proportionate increase in resistance. Fig. 2 illustrates the resistance of the iron-silicon alloys to boiling 70 per cent. nitric acid. The effect of this acid is not so violent and a smaller minimum percentage of silicon can be tolerated. The diagram shows that an alloy containing 12.5 per cent. silicon has sufficient resistance to boiling 70 per cent. nitric acid. Maximum permissible penetration of 0.1 millimetre per year is accepted for this class of material, and on this basis any alloy containing more than 14.25 per cent. silicon can be regarded as having a satisfactory acid resistance. Silicon iron of this composition will withstand successfully all concentrations of these two acids, either hot or cold or in admixture, and on these grounds they find a great many applications in acid manufacturing equipment.

Acid-resisting silicon iron is most easily attacked by the halogens and halogen acids, and Fig. 3 shows that the attack of hot concentrated hydrochloric acid is appreciable, but in the cold the rate of corrosion is negligible. The resistance of 15 per cent. silicon iron to hot hydrochloric-acid solutions is increased substantially by the addition of molybdenum. Fig. 4 shows the

* A Paper read before the London and Lancashire Branches of the Institute of British Foundrymen.

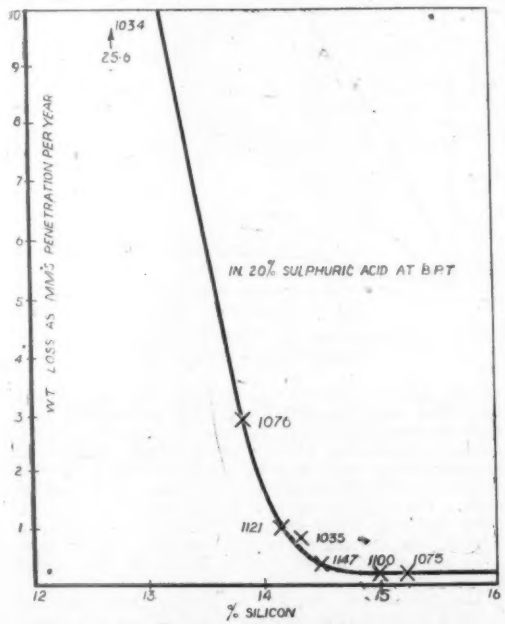


FIG. 1.—CORROSION OF SILICON IRON IN BOILING 20 PER CENT. SULPHURIC ACID.

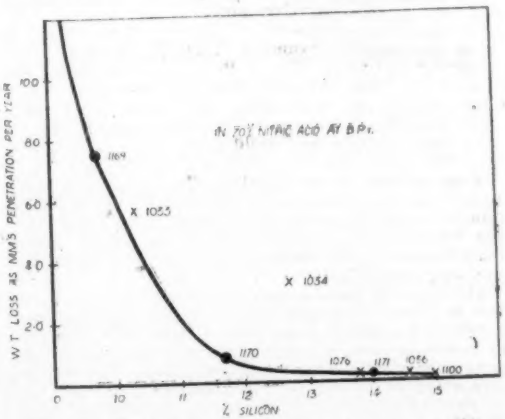


FIG. 2.—CORROSION OF SILICON IRON IN BOILING 70 PER CENT. NITRIC ACID.

High-Si Acid-Resisting Irons

results of an investigation of the corrosion resistance of a 15 per cent. silicon iron containing 3.5 per cent. molybdenum, compared with a molybdenum-free alloy in boiling 70 per cent. hydrochloric acid. The corrosion resistance is expressed as loss in milligrammes per square centimetre, and for the purposes of further comparison the curve showing the resistance of the 15 per cent. silicon alloy to boiling 20 per cent. sulphuric acid on the same basis has been included in the diagram.

The results of a determination of the corrosion resistance of silicon iron in phosphoric acid over a period of 100 hrs. are summarised in the diagram, Fig. 5. The attack on silicon iron by concentrated and dilute phosphoric acids is negligible at room temperatures. At elevated temperatures the attack by both concentrated and dilute acids was of the same order as that obtained in 20 per cent. boiling sulphuric acid.

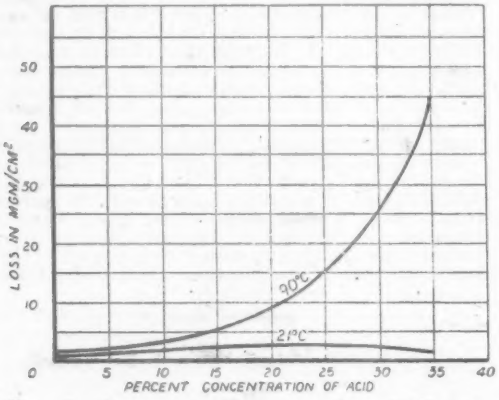


FIG. 3.—ACTION OF HOT AND COLD HCl OF VARIOUS CONCENTRATIONS ON DURIRON; 8 HRS. TEST IN AGITATED SOLUTIONS.

Tests carried out recently indicate that 15 per cent. silicon iron has a very good resistance to the hot acid liquors normally used in dye works. A polished test-bar immersed for 4,000 hrs. in a dye liquor under factory conditions remained bright and free from any sign of corrosion.

The effect of moist atmosphere conditions on silicon iron is exactly similar to that of strong acids. Below a critical percentage the alloy will rust when exposed to the atmosphere, whereas alloys of the higher silicon percentage remain quite bright and clean. The critical percentage of silicon is rather higher than that for satisfactory resistance to 20 per cent. sulphuric acid (boiling) probably in the region of 14.7 per cent. or higher. It is possible to observe acid-resisting silicon iron castings of correct silicon percentage and satisfactory acid-resisting qualities which have rusted on exposure to the atmosphere.

It is a matter of some theoretical metallurgical interest that the critical percentages of silicon in these alloys for corrosion resistances in various media should all lie at concentrations well within the alpha single-phase area—an area of uniform solid solution up to a silicon percentage of 15.7 per cent.

Mechanical and Physical Properties

The V.D.H. number for commercial varieties is probably somewhat lower than the intrinsic hardness

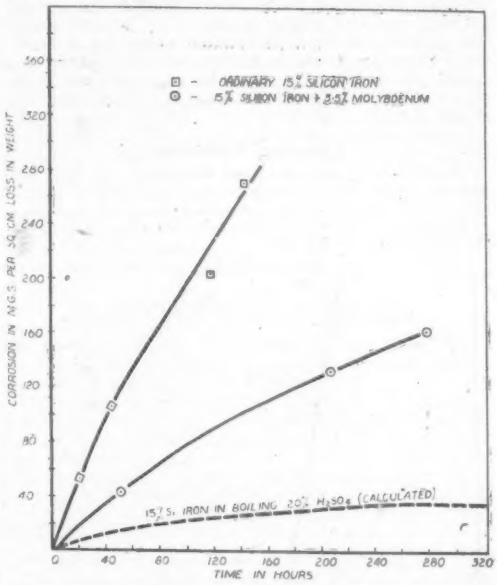


FIG. 4.—CORROSION OF SILICON IRON IN BOILING 70 PER CENT. HCl.

of the alloy. The V.D.H. number of a completely degasified slowly cooled ingot made by melting in a high-frequency furnace in vacuo was 520. It is general practice on account of this high hardness to do machining operations by grinding. With suitable machine tools machining can be done with carbide tools. Turning, boring and facing operations can be done readily by either method with suitable equipment. Drilling and tapping operations, however, are not possible and provision for bolt holes is normally made in the casting.

The mechanical strength of iron silicon alloys is lowered in proportion to the amount of silicon present. Commercial 15 per cent. silicon acid-resisting alloy of good quality has a strength value of approximately

half that of a good-quality grey cast iron. The routine determination of the strength in the author's works is carried out by transverse bending and the moduli of rupture values for 15 per cent. silicon iron are of the order of 15 to 20 tons per sq. in. and 20 to 30 tons per sq. in. for the 12 per cent. alloy, which is made for certain special purposes.

The degree of brittleness of acid-resisting silicon iron associated with the high hardness and relatively low strength has become wholly exaggerated in the minds of some chemical engineers. Acid-resisting qualities of stoneware, constructional material used

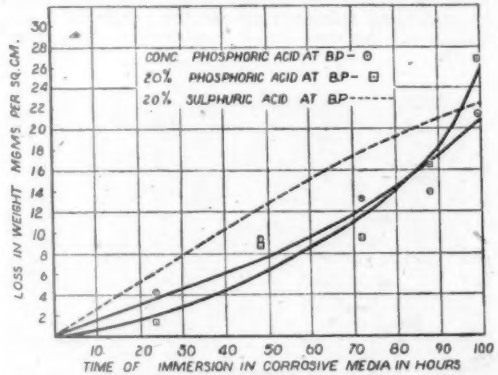

CONC. PHOSPHORIC ACID AT B.P. - ⊙
20% PHOSPHORIC ACID AT B.P. - ⊡
20% SULPHURIC ACID AT B.P.
LOSS IN WEIGHT MGMS PER SQ.CM.
TIME OF IMMERSION IN CORROSIVE MEDIA IN HOURS

FIG. 5.—CORROSION RESISTANCE OF 15 PER CENT. SILICON IRON IN PHOSPHORIC ACID OVER A PERIOD OF 100 HRS.

extensively in acid plant construction, has a strength value of only one-third that of silicon iron and from a hardness and machinability point of view is subject to similar treatment. Many of the failures encountered in the erection of plant would be avoided by handling silicon iron with care equal to that used when handling stoneware.

Certain chemical processes in acid manufacture call for equipment which will withstand highly corrosive conditions. In the manufacture and the concentration of nitric and sulphuric acids, dephlegmators, columns, evaporating pots, coolers and condensers are required to withstand these acids in all concentrations and temperatures up to 250 deg. C. The chemical composition of acid-resisting silicon iron as made by different manufacturers varies fairly widely in certain particulars and the melting procedure and technique differs in different foundries. The cupola, crucible, reverberatory, open-hearth and electric furnaces are all used. In the factory with which the author is connected electric-arc furnaces are used.

The Importance of Carbon Content

The commercial silicon iron alloys contain carbon, and as in the case of grey iron the carbon content has an important influence on the founding properties of the alloy. The presence of carbon in commercial silicon iron converts the alloy into the eutectiferous type. From experimental results in the foundry an approximate equilibrium diagram has been plotted. This is an approximate plane section of the ternary or more complex system, but it serves to indicate results of practical importance. Fig. 6 shows this diagram, which discloses the equilibrium conditions for an iron containing 15 per cent. silicon and 0.65 per cent. manganese over a range of carbon contents of 0.3 to 0.9 per cent. The appearance of the graphite in silicon iron is apparently some indication of whether the alloy is hypo- or hyper-eutectic.

Hypo-eutectic alloys have a "fine graphite" type of structure, as shown in Figs. 7, 8 and 9. The quantity of "fine graphite" becomes larger as the eutectic carbon percentage is approached. Hyper-eutectic irons contain, in addition to "fine graphite," quantities of primary or flake graphite, as shown in Fig. 10. If a molten hyper-eutectic alloy is stirred whilst cooling down, "kish" separates and the resultant casting is lower in carbon. Figs. 11 and 12 show the microstructure of the hyper-eutectic alloy before and after stirring or "puddling." The graphite flakes appear

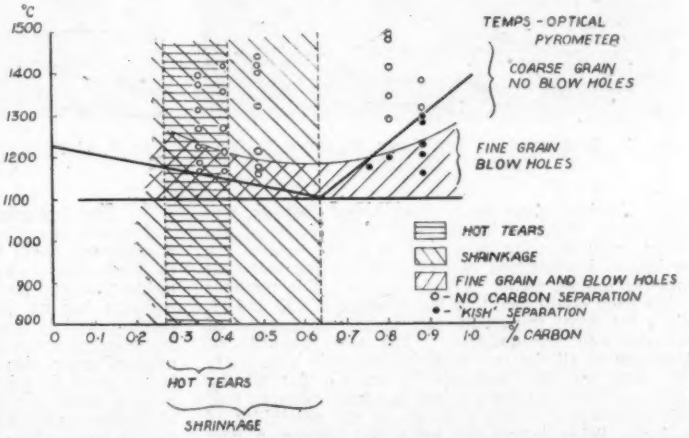


FIG. 6.—COMMERCIAL IRON-CARBON DIAGRAM FOR 15 PER CENT. SI AND 0.65 PER CENT. MN IRON.

High-Si Acid-Resisting Irons

slightly smaller in the "puddled" iron, but it is noteworthy that the percentage of carbon is not reduced to quite the eutectic value.

In the alloy of this silicon and manganese content with the carbon content of 0.50 to 0.6 per cent. sounder castings with less tendency to hot tear defects are obtained. The persistence of a carbide phase in the "as-cast" alloy will be mentioned later under the heading of heat-treatment.

The Importance of Gas Content

The greatest single trouble in the melting of silicon iron is in ensuring that the metal is sufficiently free from dissolved gases to produce sound castings, and precautions need to be taken at every stage of the entire manufacturing operation to guard against the accidental introduction of hydrogen bearing materials into the molten metal. From vacuum fusion methods it has been established that the presence of CO and H_2 plays the most important part in the production of porosity and unsoundness. The total quantity of hydrogen in all the raw materials when in a perfectly dry state was not sufficient to account for all the hydrogen found in the castings in some instances, and this observation directs attention to the possibility of moisture being introduced by a wet charge, a new lining or patch in the furnace or ladle. The ferro-silicon has been shown to have the largest hydrogen content of the dry materials charged. For example, the hydrogen content of a specimen of ferro-silicon was found to be 9 mls. per 100 grms., whilst the hydrogen content of a good silicon iron casting was 2 mls. per 100 grms.

The molten metal loses hydrogen slowly to the furnace atmosphere, and the progress of refining during melting can be observed by taking spoon samples at intervals, the extent of the refining action being judged by the extent of the "sink" in a chill cast or sand cast bar. Silicon iron is usually cast in dry sand and moulds, and although successful castings can be made in green sand, the drying of the moulds offers an additional safeguard against the accidental introduction of moisture or hydrogen into the molten metal.

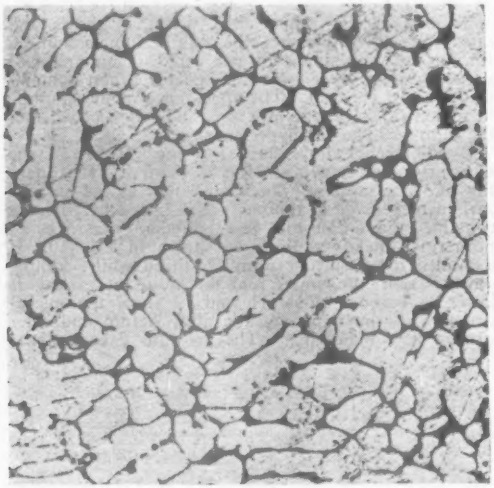


FIG. 7.—IRON WITH 15 PER CENT. SI AND 0.30 PER CENT. C (× 120).

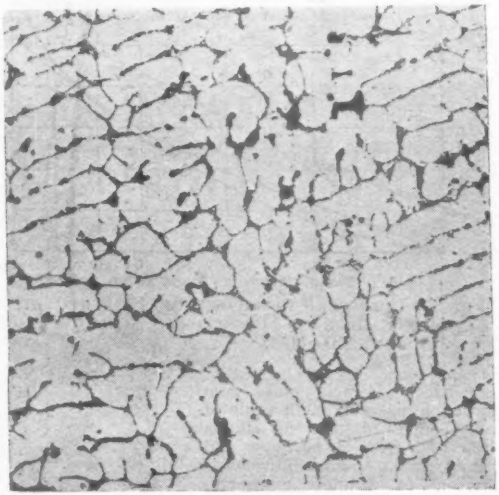


FIG. 8.—IRON WITH 15 PER CENT. SI AND 0.40 PER CENT. C (× 120).

The Importance of Casting Temperature

The rate of cooling over the solidification range has a profound effect upon the grain size of any metal or alloy, and this in turn has an influence on the mechanical and physical properties. The casting temperature has an important influence on the rate of cooling, and it is of importance to control the casting temperature within fairly narrow limits, if uniformity of grain size is to be ensured. in the castings. It has been found that if a high casting temperature is used, there is a tendency towards the formation of big columnar crystals. On the other hand, a very low casting temperature produces a very fine grain indeed. At an intermediate casting temperature a moderate fine grain with soundness results. The optimum tem-

perature range is between 1,220 and 1,280 deg. C. (disappearing-filament-type pyrometer uncorrected), the precise temperature depending upon the size and cross-section of the casting.

The shrinkage on solidification of silicon iron is much greater than that of grey iron, and patterns are made to an allowance of $\frac{3}{16}$ in. per ft. The layout of moulds and cores has to be studied carefully to take care of this large contraction. Cores especially need care, both in design and manufacture. They should be firm to withstand the pressure of the molten metal, and yet be sufficiently collapsible to give way under the contraction stresses. After the casting is completed, the cores and the mould must be released, and the castings are stripped hot and transferred to an annealing furnace.

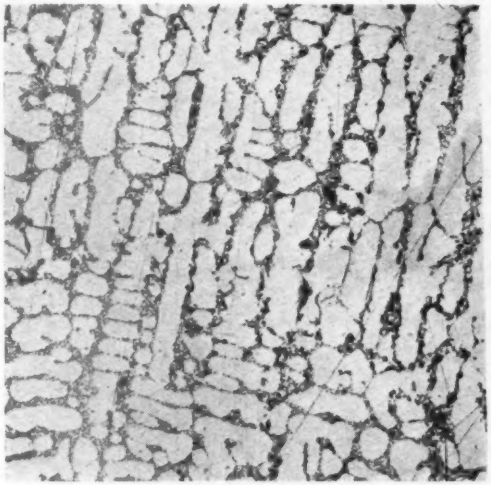


FIG. 9.—IRON WITH 15 PER CENT. SI AND 0.50 PER CENT. C (× 120).

FIG. 10.—IRON WITH 15 PER CENT. SI AND 0.80 PER CENT. C (× 120).

The Annealing of Silicon Iron

From a study of the binary thermal equilibrium diagram of the iron-silicon alloys, it would appear that for the acid-resisting irons in the region of 15 per cent. silicon no phase change takes place in the solid alloy. Although experimental work on the ternary system iron-carbon-silicon is not yet completed, all the work done so far shows that in the homogeneous alloys the only silicon phase is the alpha phase, which would be expected from the binary diagram. In view of this the exact purpose of annealing silicon-iron castings had been a little obscure. It has been doubted by some that any useful purpose was served by such heat-treatment. Others, having experienced such things as spontaneous cracking in castings after normal cooling, have considered some form of stress-relieving treatment as desirable.

Laboratory experiments have been made in order to examine the mechanical properties of silicon iron at annealing temperatures. The apparatus used consisted of a silica firebrick cut into the shape of a bridge on which a half inch diameter bar of silicon iron could be strained centrally by a wire passing outside the furnace and supporting a hanging weight.

The bar was removed from the hot furnace at intervals and the deflection was measured. By using several bars from the same cast the deflection with time over a range of temperature was obtained. Deflection commenced about the range of 650 to 700 deg. C., and was progressively greater at higher temperatures. The deflection which at first increased rapidly slowed up after a period of time. Probably the most important point brought out by the experiments was the lack of duplication of the results obtained. The points representing separate determination were scattered widely around the mean curve, and two anomalies were found in the tests done at 700 deg. C., when the bar bent in a direction opposite to the applied load. These curious results are regarded as evidence of the existence of internal stress in the "as cast" material. The permanent deflection due to the stress applied at the annealing temperatures instead of being uniform in amount in the direction of the applied stress is increased or decreased by an amount due to the internal stress. Under certain circumstances the magnitude of this internal stress can

be sufficient to bring about a negative deflection.

Experimental data show that at temperatures in excess of 700 deg. C. silicon iron disclosed a large degree of plasticity and toughness as compared with its properties at normal temperatures. At temperatures in excess of 800 deg. C. excessive softening takes place which allows of easy distortion of castings. The toughness of silicon-iron castings at these temperatures allows of their comparatively safe handling during stripping from the moulds.

Commercial silicon irons are found to contain small quantities of a carbide phase scattered at random through the whole cross section of castings. Fig. 13 shows a typical example of the occurrence of this phase, which is unstable and easily decomposed on heat-treatment. The importance of the presence of this unstable phase in commercial castings on the possibility of cracking in service is recognised.

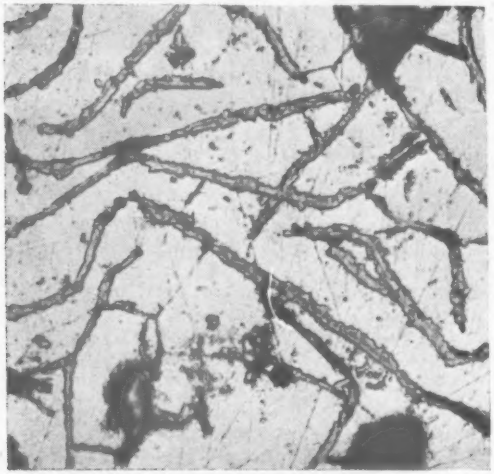


FIG. 11.—HYPER-EUTECTIC SILICON IRON CAST WITHOUT "PUDDLING" (× 600).

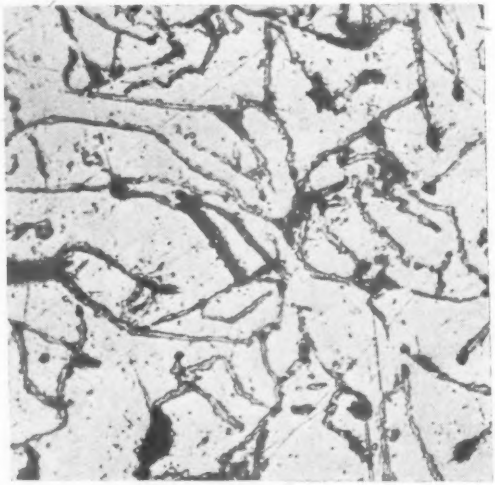


FIG. 12.—A CAST OF THE SAME IRON AFTER "PUDDLING" (× 600).

The adoption of an annealing treatment is a safeguard against the effects of internal stresses, and a treatment which brings about the elimination of the unstable carbides under conditions which leave no undesirable stresses is an additional advantage. In the treatment used at the author's works the hot castings stripped from the moulds are transferred to an annealing furnace, where they are maintained at a temperature of 800 deg. C. for a period of four hours followed by a period of slow cooling to room temperature. This operation is designed to allow the phase changes to go to completion at a temperature at which the metal is somewhat plastic and can adjust itself to internal strains without cracking. It is important not to exceed 800 deg. C. or the metal becomes too plastic and may deform under its own weight.

The Welding of Silicon Iron

Early trials with electric arc welding using 14 to 15 per cent. silicon-iron electrodes proved disappointing, and the method adopted at the author's works is the oxy-acetylene method. In the production of certain castings such as thermometer tubes, welding is very useful in that it allows of comparatively straightforward moulding methods. Long thermometer tubes, several feet long, closed at one end with core diameters of the order of $\frac{1}{2}$ to $\frac{3}{4}$ of an inch, are conveniently cast as open-ended tubes, the closed end being formed afterwards by welding.

Standard oxy-acetylene welding equipment is used, and the procedure followed is as described below:—

Preheating—The correct conditions of preheating are essential before commencing welding. It has been found necessary to ensure that the casting has reached a minimum temperature of 700 deg. C. (medium red heat) before welding is commenced, and this temperature must be maintained at and around the weld until the completion of operations. Slow cooling to room temperature in an annealing furnace is necessary after the completion of the weld. Because of this need for preheating, soaking and annealing, it has been possible

to weld very large castings with the present furnace arrangements.

Flux.—The flux found to be most satisfactory was one supplied by the British Oxygen Company for the welding of cast iron, and it is believed to consist of equal parts powdered ferro-silicon, ferro-manganese and borax.

Flame.—Sound metal can only be deposited in the weld if a slightly oxidising flame is used. A neutral or reducing flame introduces hydrogen into the molten metal pool which is given out on solidification and results in porosity. The jet size and gas pressures are carefully chosen having regard to the size of the job, so that the flame is not too fierce. Silicon iron has a high fluidity at welding temperatures, and tends to run out of the weld unless carefully controlled.

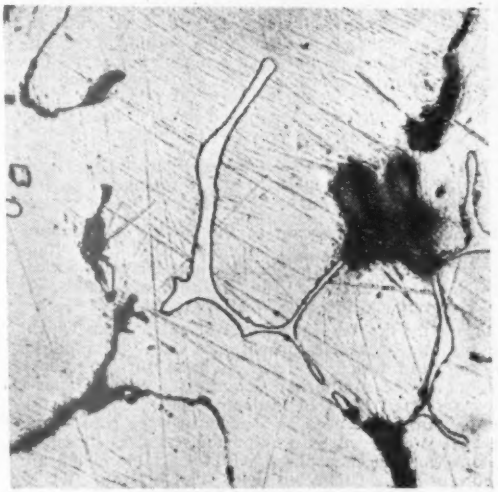


FIG. 13.—TYPICAL EXAMPLE OF CARBIDE PHASE IN 15 PER CENT. SI-IRON (× 600).

Electrodes.—Sand-cast silicon-iron electrodes of similar composition to the parent metal are used. Care is taken to remove sand by shot-blasting before welding.

Preparation of the casting.—Assuming the weld to be made on a pipe, the ends of the joint are ground to a 45 deg. "V" shape, and a sand core is used to keep them in alignment during the early stages of the weld. A band around the pipe approximately 1¼ in. from the joint is cleaned free from sand by grinding or shot-blasting.

Method of Welding.—Welding is begun when the correct degree of preheat has been obtained and the root of the "V" is welded first, taking care to ensure

(*Concluded in next column.*)

STAFF COLLEGES FOR TECHNICIANS

Dr. D. S. Anderson has summarised in the "Journal of The Institution of Mechanical Engineers" for October a verbal discussion which has been held on the subject of the "Development of Engineering Education and Technical Training." Referring to a "Staff College," to be organised on the lines of the British Foundry School, he reports that several suggestions were made that a staff college should be established. The functions of a staff college were differently conceived by different speakers, but such a college could undoubtedly fill at least three important functions:—(*a*) It could provide courses for technical staff workers selected for promotion in industry; (*b*) it could provide refresher courses for practising engineers and teachers in special subjects; and (*c*) by constant study of the growing body of knowledge in any particular subject, it could try to bridge the gap between research and teaching. It could do this by putting recent developments into teaching form, no easy task in some cases, and thereby reduce the inevitable lag between research developments and teaching practice.

STANDARD PATTERN COLOURS

In view of the fact that steps are being taken in this country to popularise standard colours for patterns, it is interesting to cite the experience of Mr. Roy M. Kinder, of Miehle Printing Press & Manufacturing Company, Chicago. In 1932, he called in all patterns from sub-contractors and their own foundries and changed them all to conform with the system standardised by the A.F.A. This meant dealing with 100,000 patterns retained in case of repairs and 15,000 in current use. The general result has been a considerable saving in time through the elimination of personal talks to the foremen of sub-contracting foundries as to how particular jobs should be moulded as the patterns now speak for themselves. There has been an improvement in surface finish, especially on those to be machined, as the pattern-colour gives this information also. Finally, there has been some saving in material as the percentage of wasters has been reduced. The fact that the patterns look nice has had the psychological effect of having greater care bestowed upon them in handling.

(*Concluded from previous column.*)

maximum penetration, and then the metal is added to fill up the space between the ends of the pipe. The pipe is rotated slowly, keeping the pool of molten metal always at the top centre until the whole weld is completed. Any irregularities are then smoothed off by sweeping movements with the torch.

Annealing.—When the weld is completed the casting should be maintained at 700 to 800 deg. C. for about an hour and then allowed to cool slowly to room temperature. Correct annealing is very important to prevent cracking troubles.

HEAT-TREATMENT BY INDUCTION

THE LEPEL SYSTEM

Heat-treatment practice in all industrial countries has undergone many changes and modifications during the last two decades. These changes include, *inter alia*, furnace design, mechanical charging and discharging, automatic temperature control, more efficient and greater selection of quenching media for specific purposes. Heat sources, also, have passed from coal and gas-fired furnaces to electric furnaces and the latest application in this direction is the use of high-frequency current. The benefits to be derived from this method of heating for hardening, annealing or stress relieving are speed and high degrees of precision and uniformity with very close control. It is also possible to apply heat locally as hot and for as long as required.

Lepel, recognising the shortcomings of the spark gaps hitherto employed, invented what is claimed to be the first dependable and really satisfactory spark gap. Because its oscillations or shock excitations, between the flat surfaces of the gaps had great extinguishing properties, he named it the quenched spark gap. The spark gap underwent most important changes—from aircooled copper-surfaced gaps to silver-surfaced gaps —then to fixed tungsten gaps—thence to the adjustable tungsten gaps—and finally the rugged watercooled adjustable tungsten gaps, which are simple and dependable. Induction heat-treating units operating on the Lepel spark gap system are made in sizes ranging from 3½ k.w. to 30 k.w. input. These units, incorporating a device which corrects the power factor to nearly unity, produce frequencies of from 100,000 to 300,000 cycles per second, this being the most practical operating range. They are being fabricated by Lepel Company, of 39, West 60th Street, New York City.

The high-frequency energy is generated in the unit and is transmitted to the object being heat-treated through "work coils" which are connected to the outside of the unit by watercooled leads. These work coils are little more than copper tubing which has been formed by a few or many turns into the shape of a coil. The object, or parts, being heat-treated are placed within the turns of the coil and are thus exposed to the field of the high-frequency current, producing in such manner the heat energy required to heat the object or the particular section where heating is required.

The heat energy is induced only in the area lying within the turns of the work coil and the effect is so instantaneous that it is a relatively simple matter to apply the coils to one section of a part, or simultaneously to two or more sections of the part, and to heat those sections in such a manner that no distortions or structural changes occur in any other section of the heated part. The extreme high frequencies at which Lepel induction heating units operate offer decided advantages, one being that the work coils are not required to fit closely around the object being heated. This enables the same coil to heat many different objects of different shapes and sizes, and in

(*Concluded in next column.*)

ISCOR'S LARGEST STEEL INGOT

On July 12 the largest steel ingot ever produced in South Africa was successfully cast in Iscor's steel-melting shop. Of octagonal shape, suitable for forging under the 3,000-ton press, this ingot has an overall length of 15 ft. 9 in., a dimension across flats of 48 in., and a weight of 40 tons. The casting was made in basic steel, taken from the inactive mixer at the steel plant. The metal was poured into the mould from a 60-ton ladle suspended on the hooks of the 110-ton overhead crane, and the tilting of the ladle was effected by the 200-ton hook of the same crane. Due to the height of the driver from the ground, field telephones were used to issue all instructions.

About 7 hrs. after casting, and while still at bright red heat, the ingot was stripped from the mould and laid in the special truck for despatch to the forge shop, where it arrived about 30 min. later. The ingot was immediately loaded into a waiting forge furnace, and heated up during the night ready for forging the following morning. The shaft into which the ingot was forged weighed nearly 30 tons and 26-in. dia. The shaft was completed in one heat, being 2 hrs. 5 min. under the press.—"Iscor News."

BOOK REVIEW

The Equilibrium Diagram of the System Aluminium-Zinc. By G. V. Raynor, M.A., D.Phil. (Institute of Metals Annotated Equilibrium Diagram Series, No. 1). London: The Institute of Metals, 4, Grosvenor Gardens S.W.1 (6d., post free).

This is the first of a new series of publications which the Institute of Metals proposes to issue, in response to the need which it feels to exist for up-to-date versions of the equilibrium diagrams of certain binary alloy systems. Each of the series will consist of (*a*) the diagram reproduced on a generous scale and based on what is regarded by a competent critic as the most reliable work in each phase field, (*b*) a table giving all important data connected with the diagram, (*c*) a number of critical notes, and (*d*) a list of references. The next alloy systems to be included in the series will be copper-tin, copper-zinc, and copper-aluminium.

(*Concluded from previous column.*)

fact often obviates the necessity of requiring oddly shaped coils to heat intricate objects.

All that is necessary to operate this type of unit is first to determine the temperature required for the particular heat-treating operation involved as well as the time cycle required to produce such temperature. The rest of the operation is merely a matter of the operator stepping on the foot control pedal with which each unit is equipped, with the operator switching the current off at the precise moment, or the operation can be equally well performed with an automatic timing device where the operation does not require the manual control of the operator.

NOTES ON OIL-SAND PRACTICE IN THE ORDINARY FOUNDRY*

Type of Sand Used — Grain Size — Making Binders in the Foundry —Storage and Drying

By WM. Y. BUCHANAN

In these notes, the author has intentionally kept to the subject of oil-sand practice in the ordinary foundry because, while he thoroughly appreciates the remarkable efforts in mechanisation by foundry equipment firms, it is in the ordinary foundry, *i.e.*, the foundry making a great assortment of castings daily, that the foundryman has to plan and develop his own methods to a large extent. He is usually limited by such factors as lack of space, small numbers and great variety of types of castings which do not lend themselves to mass production methods.

There are many types of inexpensive and readily adaptable machines which come between the two extremes of mechanisation at its best or where it is entirely absent, and it is often advantageous, and always interesting, to keep in touch with developments in new plant as they appear in the technical Press. Oil-sand practice has, of course, become largely mechanical, like most general founding work, *i.e.*, the sand is mechanically mixed, often mechanically conveyed, rammed, dried, fired and even mechanically knocked out.

Type of Sand

The first consideration in oil-sand practice is the choice of sand. While there are a number of important factors—such as (*a*) grain size, (*b*) distribution, (*c*) type and chemical composition, (*d*) regularity of quality, and (*e*) relative freedom from fines and clay, etc.—convenience of location may often outweigh some of these defects or undesirable characteristics in a sand.

In the Glasgow district, the sea sands or tidal deposits down the south-west coast and also available in earlier deposits far inland are quite well suited to the making of oil sand and, of course, have been in use for a long time. Owing to the presence of outcrop coal measures in the tide-washed rocks on some parts of the Ayrshire coast, grains of coal may exist in the sand, but most deposits supplying the foundry industry are free from this undesirable impurity.

Lately, however, there is an increasing tendency to find deliveries of sea sand containing large stones and quantities of coarse roots, which suggests that some suppliers are excavating in new places which in times of lower market demand would not have been touched. This may be merely a transient phase brought about by the temporary labour shortage in some cases.

The sands from this area bought from old established firms have always been very free from foreign matter, making sieving more or less unnecessary, and this was always a big advantage, more particularly if it is used without preliminary drying. There are some specially-prepared silica sands in successful use with a wide application in steel and ironfoundries, and no doubt there are some sources better than others. One, detailed in Table I, was tried as a substitute for Irvine sand. It will be noted that the alternative sand has a much higher percentage of material smaller than 100 mesh (smaller sieves are not included in the range for these tests).

The clay test, which is carried out according to the A.F.A. recommended method, shows a considerable percentage in the sand, so much so that the alternative sand had a considerable green and dry strength without any additions. The silica content of the alternative sand, which is usually an important feature of their specification and claim to superiority, did not, however, show a higher percentage than that of the Irvine sand, although the iron-alumina impurity content is only about half that of the Irvine sample tested.

Grain Size

Irvine sea sand and linseed oil, properly mixed, rammed and baked, generally speaking makes a core of very high permeability and maximum strength, but very high permeability very often reacts unfavourably on surface conditions, even when coated with a special wash, giving roughness and searching particularly in bronzes. This is usually corrected to some extent by the addition of fine sand, which may or may not be clay bonded. Both of these additions, *i.e.*, fine sand and clay bond, to oil sand have an adverse effect on the amount of oil binders required

TABLE I.—*Samples Put Through ⅛-inch Riddle Before Testing.*

Mesh.	Irvine sand.	Washed silica sand.
22	1·93	5·10
44	7·85	8·95
72	42·36	37·63
100	40·11	27·63
Pan	7·05	20·18
Clay, A.F.A.	0·17	5·25
SiO_2	88·8	86·76
Fe_2O_3 } Al_2O_3 }	5·80	3·16

* A Paper read before the Scottish Branch of the Institute of British Foundrymen.

Oil-Sand Practice

to give a definite dry strength. Clay, besides counteracting the high dry strength, reduces the ease of coring during dressing, which is perhaps one of the best features of oil sand.

The extent to which fineness of grain size increases surface area is not generally realised. In Aptaker's Paper, "Core Making" (A.F.A. Proceedings), the relation of grain size to surface area is demonstrated. For example, 1 cm. cube reduced to small cubes of 0.1 mm. side results in 1,000,000 pieces being formed, the surface area being increased from 0.93 sq. in. to 93 sq. in. The table he gives carries the sub-division to a micron, but this is outside practical politics, for the film of heavy oil binder will not be smeared over pieces below a certain size no matter how efficient the process. Nevertheless, without going too far down the table, it will be readily understood why an increase in fineness in core sand causes an increase in consumption of core oil.

The Making of Binders in the Foundry

It does not appear to be any longer worth while to make core oil mixtures in the foundry, and it is certainly not worth while to install mixing plant for the purpose now. The established suppliers have improved core compounds considerably in the last few years. There is still a wide range of products to suit core practice, both old and new. The author's experience of making core compounds consisted of an investigation in the laboratory in the absence of available data, into the properties, singly and in combination, of such materials as linseed oil, dextrine, molasses, resin, flour, starch, sulphite lye, powdered pitch, etc., with careful regard to ultimate cost per cwt.

The most reliable and generally useful in general engineering castings of iron and non-ferrous metals was found to be a simple linseed oil/dextrine/water mixture which was compounded in a simple cylindrical vessel stirred mechanically by a series of paddles. This was made of the consistency of cream so that it could be run off, and the mixer was placed adjacent to a large pan mill in which the oil sand was made. At the time, about 1931, this home mixed material was very considerably cheaper than similar materials offered for sale to foundries, and at the time little was known of the composition of core oils by the ordinary foundryman.

About this time the B.C.I.R.A. issued to members a very comprehensive survey of the available materials and their properties in the form of various combinations, as regards relative superiority of resistance to moisture, dry-strength temperature of destruction of binder, and this formed a very useful addition to the knowledge of the whole subject, casting a welcome ray of light in some very dark places.

Individual research of the kind referred to earlier is no longer necessary unless to clear up points arising from local conditions in any one foundry. Dietert's recent book covers this subject very thoroughly and is an excellent book of reference for the student, research worker and up-to-date foundry executive alike. This book, which is issued by the A.F.A., is based on the contributions of a very long list of well-known American foundrymen.

Storage and Drying

In planning storage for core sand, it is, of course, essential to study the requirements with a view to fixing the amount of stock carried, *i.e.*, a fixed number of trucks per month, and at the present making allowances for belated long railway delivery times. It is most convenient, of course, to arrange for the storage alongside the railway siding so that trucks can be unloaded by shovelling direct into a large shed or receptacle, preferably with a roof covering.

In such a building or covered bin a considerable amount of natural drying goes on by the filtering effect which tends to concentrate the moisture in the lowest layers of the storage heap, which in turn is seldom drawn upon when the stock is regularly kept up.

Irvine sand is particularly prone to dry out in this way, and this makes it available after a short period of storage in a condition containing relatively little moisture. Some samples taken throughout the storage heap gave the following percentages of moisture which can be taken as typical of the conditions likely to occur:—Dried naturally, 1.00, 1.20 and 1.60 per cent.; average as charged to mixer, 4.00 per cent.; and very wet owing to exposure to rain, 12.0 and 17.0 per cent.

The substitute sand, with its increase in fine material, is unlike natural sea sand in that it does not dry out to the same extent and, as it is always delivered in a very wet condition, it contains far too much water. When using linseed oil, linseed-oil/dextrine-cream mixture, and linseed-oil semi-solid mixture, it has hitherto been a practice to dry out the sand thoroughly before commencing mixing. This means that the binder is first thoroughly dispersed through the dry sand and the final bond developed by the addition of a minimum amount of water.

The drying of large quantities of sea sand daily is quite a problem for the ordinary jobbing foundry and in the case of large mechanised foundries the cost of drying plant and space required is a very important item. Small drying units are, of course, available and these have a useful place in jobbing work apart from making oil sand, but they have a limited capacity, however, and this capacity in turn controls the rate of expansion of oil-sand core mixing in an emergency, such as sudden change of design or a demand for increased production at very short notice. The large output drying units are of the well-known rotary-type, gas or coke fired, with many recent improvements to give a very rapid drying time.

Of more direct interest to the average foundry is the range of smaller units designed to enclose the firebox in a sort of jacket for holding the sand to be dried. There are several forms of these which have worked for a number of years with reasonable replacements. One used by the author for a number

of years is shown in Fig. 1. This has some features which are rather different, and it may be of interest in that it was designed for ease of construction and freedom from replacements. It consists, in principle, of two plates set to form a "V," with small space between the bottom edges, *i.e.*, about ½ in. A heavy cast-iron tube is built into the ends so that its outside surface is about ½ in. from these plates.

The wet sand is heaped into space between the plates covering the cast-iron tube. While the sand is wet, no movement goes on, but when a fire is kindled in the tube, the dry sand slides over the pipe and runs out at the bottom of the "V," so that fresh moist sand comes in contact with the hot pipe. The pipe is used in order to simplify the construction of the firebox and keep the combustion slow and complete, at the same time eliminating firebars and absorbing all the heat of the fire and ash in the sand. The ash is gradually pushed back until it falls into the base of the flue.

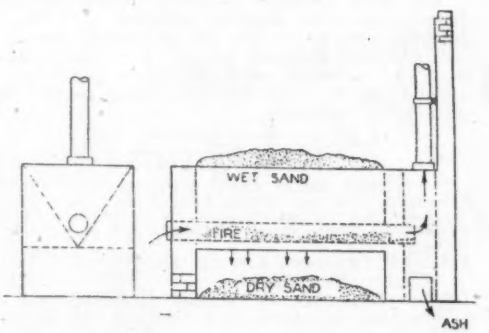


FIG. 1.—SMALL CAPACITY SAND DRIER SUITABLE FOR CONSTRUCTION IN JOBBING FOUNDRIES.

If the thickness of the pipe is about 1¼ in., it will last indefinitely. The conductivity might be improved by vertical fins cast on the pipe. The bore of the pipe can be as small as 8 in. and the distance between the end walls 5 ft. without requiring support for the centre of the tube. This particular drier depends on natural draft, has a maximum capacity of 36 cwts., each "fire" consists of 10 lbs. coal, and the rate of drying is about 1 cwt. per hr., depending on the original moisture, and the fuel consumption 1.7 lbs. per cwt. of sand dried.

This figure, from the point of view of economy only, seems very good. The rate per hour could no doubt be increased by increasing the length of the drying chamber, making suitable provision for supporting the cast-iron tube to prevent sagging. Fig. 2 shows a possible modification with the object of increasing the efficiency by doubling the gases back again through the wet sand.

The introduction of oil binders of the powder type free from water, *i.e.*, consisting essentially of linseed oil and dextrine or similar material, without the addition of water, is one of the most important developments in oil-sand practice in recent years, since it allows all sand being used without preliminary drying and a consequent saving of fuel and labour, while at the same time obtaining a flexibility of production hitherto quite unknown. In short, with this powder binder the advantages are: lower transport costs, extreme convenience in storing, handling and measuring for mixing, and possibly a shorter mixing cycle, in addition, of course, to the eliminating of drying and incidental labour.

Further, since the sand is not to be dried, there is no necessity to transport it to some improvised drying arrangement usually situated inside the foundry itself, and this means that the oil-sand mixing machine can be situated at the railway siding where the oil sand is produced in a cool moist atmosphere, and thus the common tendency for oil sand, produced in

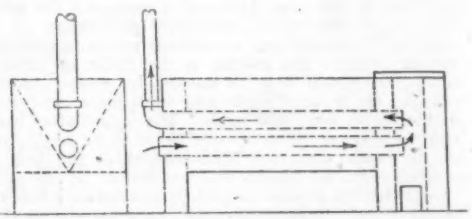


FIG. 2.—AN IMPROVED ARRANGEMENT OF THE DRIER SHOWN IN FIG. 1 INTENDED TO USE THE HEAT OF THE FUEL MORE EFFICIENTLY.

the foundry, to dry out, is reduced. It appears, however, that a large number of foundrymen still do not take advantage of this new technique in using undried sand, and it is for this reason that attention is drawn to what has been common knowledge for a number of years.

(To be continued.)

Bentonite, according to the [American] Bureau of Mines, is finding increased favour in the foundry industry. Its consumption has trebled since 1930, and exports continue to rise, although not at the same rate.

Nickel Bulletin.—The November issue of "The Nickel Bulletin" includes abstracts dealing with the present position of electrolytic polishing, the fatigue strength of nickel alloy and copper alloy wires, a new manganese-copper nickel alloy, tempering reactions in nickel-molybdenum steels, the determination of oxygen, hydrogen and nitrogen, and the influence of nitriding on fatigue strength. Copies of the Bulletin may be obtained, free of charge, from The Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

SAND ADHERING TO THE SURFACE OF CASTINGS

SOME AMERICAN CONCLUSIONS

At the last annual meeting of the A.F.A., Mr. J. B. Caine presented a well-thought-out study reinforced by much research work on "burnt-on" sand. He summarised his conclusions in the following statement.

A study has been made of the mechanism of "burnt-on" or adhering sand, establishing the fact that, in steel practice at least, this adhering sand is due to penetration of the metal into the sand, mechanically locking it on to the casting. Adherence due to fusion plays only a minor part, if it enters into the picture at all. Pure mechanical penetration due to too large voids being present in the sand as rammed is the major cause of adhering sand in the steelfoundry. Decreasing the void size by decreasing the grain size of the sand decreases penetration and adhering sand in this case, although it decreases the refractoriness of the sand. Although penetration of the sand by the metal and subsequent mechanical locking of the sand to the casting is the cause of adhering sand, this action can be caused by fusion and the opening up of large voids and subsequent penetration of the metal into these voids. The action after fusion and opening up of the voids is the same as if voids of the same size had been present in the sand as rammed and no fusion had occurred.

As adhering sand is caused by penetration, the temperature of the metal and sand-metal interface assumes greater importance than before. Not only must the sand be heated to a temperature high enough to melt any fusible constituent in order to cause penetration, but it must be heated to above the melting point of the metal. If for any reason, whether it be because the metal itself is close to its solidification temperature, or heat flow through the sand is so great as to keep the sand below this temperature, there will be no penetration regardless of how fusible the sand or how large the voids.

The action of silica flour, whether added to the sand mix or added as a wash, is complex. A mixture of the fine grains of silica flour and the coarser grains of the base sand, increases penetration and adhering sand, but a uniform face of the fine grains of silica flour in contact with the molten metal decreases penetration and adhering sand up to a certain point depending on the temperature of the sand-metal interface. Beyond this point the silica flour breaks down suddenly and bad "burn-on" occurs.

Impurities present in the A.F.A. clay fraction do not lower the "B" sintering point enough to cause adhering sand until percentages much above those usually encountered in moulding sands are reached. Much smaller percentages of the same impurities, when present in the A.F.A. silica fraction, will cause trouble. This is due to the fact that equilibrium is established much faster when the impurities are present as silicates in the A.F.A. silica phase than when they are present as a separate phase in the A.F.A. clay fraction.

Strong fluxes such as borax, when added to the A.F.A. clay phase to form a glaze which acts as sort of an automatic wash, are too sensitive to temperature to be of practical value. For example, the correct amount of borax to give this glaze on the outside surfaces of a casting will cause bad penetration and adhering sand at re-entrant angles and pockets of the same casting. The steelfoundry-man is using a glaze when he adds silica flour to the sand under proper conditions. As has been shown, this silica flour glazes and forms a very viscous film, preventing metal penetration. The fact that bentonite and crude sands tend to give better peel is due to this same condition. Both lower the sintering point slightly, and cause a glazing action. The use of iron oxide with pure silica sands, in addition to having other advantages, also lowers the sintering point slightly and again gives a viscous high silica glaze.

The most foolproof method whereby the steelfoundry-man can decrease adhering sand in the foundry is to use as fine and as uniform a sand as will give him the other physical properties required. The "B" sintering point should be controlled at about 55 deg. C. lower than the average pouring temperature of the metal.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

557,204-5 QUALCAST, LIMITED, and JOBSON, J. E. V. Casting of metals.

557,210 BOYCE, G. E. Method of forging and refinishing detachable drill bits and the like and apparatus therefor.

557,256 EASYCANTOP, LIMITED, and WALENSKY, B. Means for scoring sheet material or of containers or other articles of sheet material.

557,262 BIRMINGHAM ALUMINIUM CASTING (1903) COMPANY, LIMITED, PRITCHARD, P., and TAYLOR, G. O. Furnace for the electrical melting and/or heating of aluminium and alloys thereof, and for the recovery of the metal from aluminium dross residues.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"PEAK"—Gear wheels. REAY GEARWORKS, LIMITED, 1, Oakwellgate. Gateshead-on-Tyne.

"TERRIC"—Fluxes. METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED. 1, Kingsway, London, W.C.2.

"COMMODORE"—Metal hose-pipe clips. E. F. DOWLING, 22, Central Parade, St. Mark's Hill, Surbiton, Surrey.

"PIREKS"—Alloys of common metals. DARWINS, LIMITED, Fitzwilliam Works, Templeborough, Sheffield.

Save Fuel
in your CUPOLAS
by using
STANTON
SAND-LESS
Machine Cast
PIG IRON
THE STANTON IRONWORKS COMPANY
LIMITED NEAR NOTTINGHAM

NEWS IN BRIEF

THE PARTNERSHIP between Campbell Forrest, Ralph Sym and Campbell Forrest, jun., carrying on business as ironfounders and engineers, at Philip's Park Road, Manchester, 11, as FORREST & SYM, has been dissolved by mutual consent. The business will continue to be carried on by Ralph Sym under the same name.

THE PARTNERSHIP between Hector Huntriss and John Francis Kenrick, carrying on business as mineral merchants at 3, Rumford Place, Liverpool 3, under the style of GEO. HUNTRISS & COMPANY, has been dissolved by mutual consent. Debts will be received or paid by Hector Huntriss, who is carrying on the business.

THE COMPANIES REGISTRATION OFFICE gives notice that the names of the undermentioned companies have been struck off the register, and such companies are dissolved:—Brades Metal Company, Limited; Chemical Plant & Equipment Company, Limited; Electrical Manufacturing & Plating Company, Limited; Metal Protection (Europe), Limited.

MR. L. F. WRIGHT, chairman of Gjers, Mills & Company, Limited, Middlesbrough, has been re-elected president of the Cleveland Institution of Engineers, and Mr. F. G. Webster vice-president. The Institution is to hold a joint meeting with the Iron and Steel Institute in Middlesbrough on December 18, when a Paper will be read by Mr. N. L. Evans, of Northwich, on the use of basic-lined ladles.

PROPOSALS which include the opening of manganese ore mines and the starting of a limekiln have been put forward by a general interest committee which has been formed in Tomintoul, the second highest village in Scotland. The committee states that manganese ore workings were in operation a century ago, when the ore was sent by pack pony across the hills to Garmouth for shipment to the south. These could be reopened. There is also said to be an unlimited quantity of limestone in the district.

THE PARTNERSHIP between Henry Howlett, Charles Edgar Howlett, and Stephen Joseph Howlett, carrying on business as foundry proprietors at Brookfield Foundry, Bryan Street, Hanley, Stoke-on-Trent, and at California Works, Stoke-on-Trent, under the style of THE BROOKFIELD FOUNDRY & ENGINEERING COMPANY, has been dissolved by mutual consent. Debts will be received and paid by Charles Edgar Howlett and Stephen Joseph Howlett, who will continue to carry on the businesses under the same firm name.

A SPECIAL COMMITTEE of the Advisory Council of Education in Scotland has been formed to inquire into the provisions, administration and finance of technical education outside the Universities, having regard to the special prospective needs of trade and industry. Mr. D. Penman, Mr. Wilfrid Ayre (chairman and managing director, Burntisland Shipbuilding Company, Limited), and Mr. E. Bruce Ball, Jnr. (joint managing director, Glenfield & Kennedy, Limited, Kilmarnock), are members of the committee.

SPEAKING at the Wolverhampton Production Exchange, Mr. F. D. Kilby, manager of the Wolverhampton district office of the Ministry of Production, said that the exchange, the only one of its type in the country, had during the last eleven months reached attendances of nearly 8,000, and the known transactions totalled £657,000. He saw no reason why this simplified method of transacting business with correspondence cut down to a minimum and its freedom from "that bane of all industrialists, Government forms," should not continue during the post-war reconstruction period.

UNDER THE SPECIAL ARRANGEMENTS which enable registered traders to export chargeable goods free of purchase tax on behalf of unregistered persons through the medium of approved export packers, the responsibility for satisfying the Commissioners of Customs and Excise that the goods have been exported rests on the registered trader. Cases have come to notice where evidence of exportation has not been readily available because the registered traders, when forwarding the goods to the approved export packers, had not made it clear that the goods were being delivered under the special arrangements. Registered traders taking advantage of the concession should, therefore, in their own interests, notify the packer that the goods are being sent to him for exportation under the special arrangements, the Customs and Excise authorities point out.

OBITUARY

MR. WILLIAM SHAW, of the Denton Engineering Company (1931), Limited, Hyde, Cheshire, died on November 25.

MR. JOHN DICK, director of Marshall, Fleming & Company, Limited, cranemakers, Motherwell, died on November 25.

MR. ISAAC GAUNT BUTLER, head of Samuel Butler & Company, Limited, bridge builders, of Stanningley, Leeds, has died at the age of 65.

MR. R. S. COX, proprietor of Cox & Jones, Falcon Foundry, Northampton, died on November 17, after a short illness. He was 54 years of age.

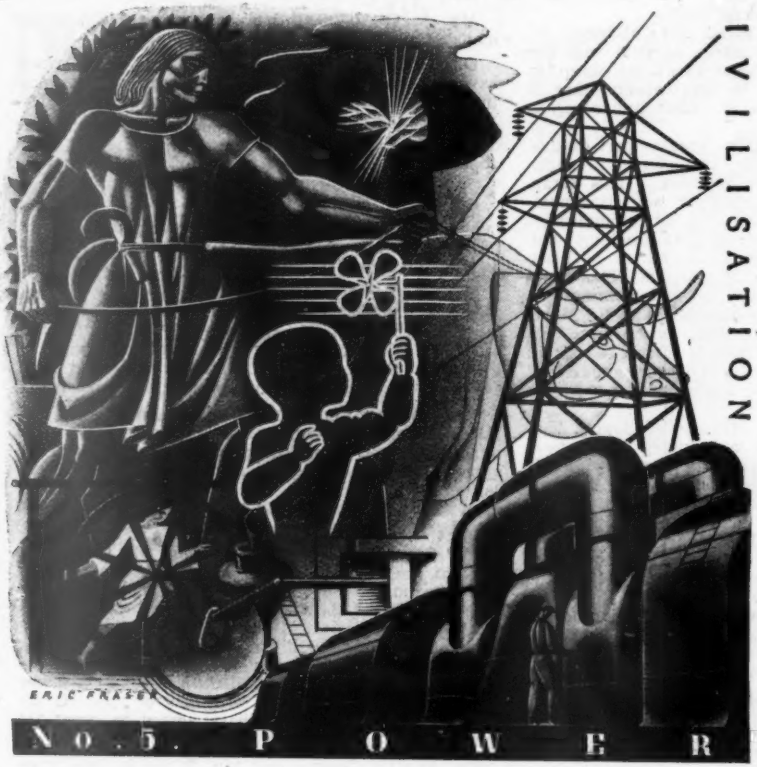
MR. JAMES ALEXANDER M'MASTER, who was for over 50 years with George Robertson & Sons, Limited, brassfounders, of Paisley, died recently.

MR. GEORGE HENRY DRAKE, general works superintendent of Davy & United Engineering Company, Limited, Sheffield, has died at the age of 45.

MR. MEYER HART GOLDSTONE, chairman of Ward & Goldstone, Limited, electrical equipment manufacturers, Salford, has died at his home in Southport.

MR. JOHN WALTON HARRISON, director and secretary of Richard Hill & Company, Limited, Newport Rolling Mills, Middlesbrough, died suddenly at his residence at Saltburn last week in his 71st year. He had been in the service of the company for over half a century.

FUNDAMENTALS OF CIVILISATION



No. 5. POWER

THE UNITED STEEL COMPANIES LTD

Since the dawn of time man has endeavoured to utilise power to provide for his needs. In early times power was wrested from the muscles of slaves or from the patient ox. Medieval man harnessed the wind and water to turn his mills and grind his corn.

To-day the engineer makes use of a third element—fire and, with air and water, generates many thousands of horsepower in one place, whence it is distributed to do useful work at many distant points.

These modern miracles have been made possible by the special and alloy steels evolved to suit the complex conditions in the operation of high temperature water tube boilers, in the turbines and electrical generators. Electric pylons of steel stride across the countryside carrying the invisible current for conversion into power at the bidding of man.

THE UNITED STEEL COMPANIES LIMITED

STEEL, PEECH & TOZER, SHEFFIELD
SAMUEL FOX & CO. LTD., SHEFFIELD
UNITED STRIP & BAR MILLS, SHEFFIELD
APPLEBY-FRODINGHAM STEEL CO. LTD., SCUNTHORPE
WORKINGTON IRON & STEEL CO., WORKINGTON
THE SHEFFIELD COAL CO. LTD.
THE ROTHERVALE COLLIERIES, TREETON
UNITED COKE & CHEMICALS CO. LTD.
THOS. BUTLIN & CO., WELLINGBOROUGH

U.S.P. 20

PARLIAMENTARY NOTES

Iron and Steel Municipal Scrap

MR. ROBERT MORRISON asked the Minister of Supply what action he was taking to deal with the accumulations of iron and steel municipal scrap in various areas; and whether he was satisfied that it was still necessary to continue to collect and segregate the material.

MR. C. U. PEAT said that the greater part of this material was destructor scrap, consisting of empty tins and discarded household utensils. This scrap was bulky and expensive to treat and transport. Owing to the presence of tin and other impurities it could not be used directly for steelmaking, but could only be used in limited quantities in blast furnaces for the manufacture of pig-iron. The scrap in question had been of great use in increasing the output of iron from the furnaces, but thanks to the efforts of the public and the local authorities they had now accumulated a substantial reserve stock of iron and steel municipal scrap, and the present collection had increased to a point exceeding the capacity of the industry to consume.

In these circumstances the Minister of Supply had decided that the scheme for compulsory segregation and collection of domestic ferrous scrap by local authorities should be continued only in the case of those equipped to enable the material to be readily utilised, and that it should be discontinued in the case of other local authorities. This did not imply any change in the demand for other types of ferrous scrap suitable for direct use in the steel furnaces. The need for this was greater than ever. Some of the abnormal sources of supply they had tapped were beginning to dry up and this would necessitate intensified efforts in other directions.

CANADIAN IRON AND STEEL INDUSTRY

Canada has attained a production rate for steel ingots at approximately 3,000,000 tons per year and a pig-iron capacity of 2,500,000 tons annually, which is more than double the capacity for these materials at the beginning of the war, according to the Department of Munitions and Supply. Rolling mill and other steel products also have shown corresponding improvement in the war years, but despite this step-up in output, there will be no increase in supply of steel for non-essential civilian consumers. Of the 5,000,000 tons of steel that will be used in Canadian war plants and essential civilian industry this year, only about 2,000,000 tons will have to be imported from the United States, whereas previous to this year imports on war account provided more than 50 per cent. of requirements. Canadian steel mills, despite substantially enlarged capacity, have not yet reached maximum output, chiefly due to labour shortage. However, on some lines of steel, particularly plate, output is being maintained well above rated capacity and production this year is 300,000 tons ahead of the rate for 1939.

PERSONAL

MR. A. C. BERNARD has been appointed assistant manager of the Carron Company, Falkirk.

DR. C. J. T. CRONSHAW and MR. D. R. LAWSON have been appointed directors of Imperial Chemical Industries, Limited. Both are members of the staff.

MR. ERNEST H. COOPER, chairman and managing director of Gillette Industries, Limited, has been appointed public relations officer of the Government of Northern Ireland in London.

MR. P. H. WILSON, assistant managing director (technical) of the Stanton Ironworks Company, Limited, has been appointed deputy managing director as from December 1.

MR. H. SOUTHERN, of G. P. Wincott, Limited, Sheffield, has been elected chairman of the council of the Society of Furnace Builders, MR. P. HOPKINSON, of British Furnaces, Limited, Chesterfield, a member of the Council, and MR. A. GARSTANG, of King, Taudevin & Gregson, Limited, Sheffield, the treasurer.

MR. THOMAS LEO HALE, vice-chairman of Hale & Hale (Tipton), Limited, malleable iron founders, has retired from the board owing to ill-health. Mr. Raymond Charles Leppington has been appointed vice-chairman in his place, and two further directors, namely, Mr. Frank Coe and Mr. John Anthony Wylde, have been appointed.

SIR CHARLES HAMBRO, chairman of the Great Western Railway, has been appointed by the Minister of Production to be United Kingdom member of the Combined Raw Materials Board, and head of the British Raw Materials Mission in Washington, in succession to Sir Clive Baillieu, who has held these posts since the formation of the two bodies, having previously served as head of the British Purchasing Commission. The board of directors of the Great Western Railway Company have agreed to grant Sir Charles Hambro temporary leave of absence.

MR. A. G. E. BRIGGS and MR. H. H. BURTON have been appointed directors of the English Steel Corporation, Limited. Mr. Briggs, special director and sales manager of the E.S.C., Limited, and director of the Darlington Forge, Limited, was at the beginning of the war lent to the Ministry of Supply. Until recently Deputy Controller of Iron and Steel Supplies, he is now Joint Deputy Controller of Raw Materials. Mr. Burton, chief metallurgist and special director of E.S.C., Limited, and director of Darlington Forge, Limited, has been associated during the war with many of the technical committees set up by various Ministries.

Wills

BAILEY, F. M., of Hale, Cheshire, engineer ...	£49,752
EYRE, R. E. H. W., of Chesterfield, managing director of Ryland Works, Limited	£36,606
BACON, FREDERIC, formerly Professor of Engineering at Swansea University College	£10,326
GEORGE, H., managing director of Brown & Green, Limited, engineers, and founders, Luton ...	£80,347

NO. 10 PREPARED BLACKING

● The Latest Core and Mould Wash for IRON CASTINGS

●

STEELMOL

for STEEL and SPECIAL IRON CASTINGS

HIGH CARBON BLACKING
CEYLON PLUMBAGO
TERRA FLAKE · COAL DUST · GANISTER AND
ALL FOUNDRY SUPPLIES

JAMES DURRANS & SONS LTD

PHŒNIX WORKS & PLUMPTON MILLS, PENISTONE, near SHEFFIELD
Telephone: PENISTONE 21 and 57
Telegrams: BLACKING PENISTONE

THIS HOPPER ACTS AS PRE-HEATER

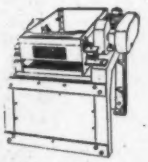
"POLFORD"

TILTING FURNACE

Saves Fuel
Saves Time
—Gives Longer Life to Crucibles

For melting non-ferrous metals, this unit has been designed for rapid fusing, mobility, flexibility of control and low fuel consumption. Made in various sizes for crucibles of 100 lbs. to 1200 lbs. capacity; coke, oil or gas firing. Fitted with Drop Bottom, operated instantaneously in emergency. Write for prices and full details.

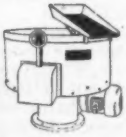
May be used as either a Fixed Type Crucible Furnace or as a Tilter.



VIBRATORY SCREENS

Other **"POLFORD"** *Products*

CRUCIBLE FURNACES



CORE SAND MIXERS

THE HEATON FOUNDRY CO. LTD.
Makers of Foundry Equipment,
HEATON JUNCTION, NEWCASTLE UPON TYNE, 6.

COMPANY RESULTS

(Figures for previous year in brackets)

Hepworth & Grandage—Dividend of 12½% (same).

Bradley & Foster—Interim dividend of 4% (same).

Wellman Smith Owen Engineering—Interim dividend of 5% (same).

Butler Machine Tool—Dividend of 12½% on the ordinary shares (same).

Briton Ferry Steel—Interim dividend on the ordinary stock of 2½% (same).

South Durham Steel & Iron—Final dividend on the ordinary shares of 6% (same).

J. Brockhouse—Final dividend on the ordinary shares of 12½%, making 20% (same).

Fleming & Ferguson—Final dividend of 2s. per share, making 15% for year (same).

Imperial Smelting Corporation—Net profit, £119,167 (£119,352), after charging income-tax, N.D.C. and E.P.T.

Heenan & Froude—Net profit, £42,487 (£48,717); final dividend of 5% and a cash bonus of 5%, making 15% (same).

Birmid Industries—Dividend of 10% (same), plus a cash bonus of 7½% (same), in respect of the year ended October 31, 1943.

Weardale Lead—Profit for the year to September 30, 1943, after allowing for depreciation at 5%, was £1,853, reducing the debit brought forward to £737.

John Shaw & Sons—Interim dividend on the ordinary shares of 7½% (same). In due course the directors will recommend this dividend as final for the year (as in the previous year).

John I. Thornycroft—Profit for the year to July 31 last, £166,259 (£143,820); dividend on the preference shares, £12,000 (same); reserve, £50,000; preferred ordinary dividend of 9% (same); ordinary dividend of 13% (same); forward, £105,533 (£75,700).

Kendall & Gent (1920)—Net profit, after charging war damage contribution and depreciation, £28,248 (£38,082); final dividend of 10% and a bonus of 5%, making 20% (same); taxation, £10,000; to war contingencies' reserve, £10,000; forward, £14,441 (£17,194).

Crompton Parkinson—Profit for the year ended September 30, £431,413 (£410,498); final dividend on the ordinary and "A" ordinary stock of 7½% (same), and a special cash bonus of 7½% (5%), making 22½% (20%); benevolent fund, £5,000; forward, £488,657 (£389,744).

Wolverhampton Die-Casting—Net trading profit for the year ended June 30, £36,769 (£29,614); depreciation, £7,827; reserve for income-tax, £17,340; net profit, £11,601 (£10,801); final dividend of 7½% on the ordinary shares, making 12½% (same); forward, after preference dividend, £20,649 (£13,493).

Ductile Steels—Profit for the year to June 30, after depreciation, war risks insurance, E.P.T. and N.D.C., £23,851 (£20,139); income-tax, £13,000 (£12,000); dividend on the preference shares, £1,500; final dividend on the ordinary shares of 5%, making 10% (7½%); written off goodwill, £5,000; forward, £7,731 (£7,130).

Samuel Osborn—Net profit to July 31, after provision for pensions and contingencies, depreciation, bad and doubtful debts, income-tax, war damage contribution, and E.P.T., £55,916 (£54,630); to reserve for war contingencies, £25,000 (same); 5½%, tax free, preference dividend, £7,183; ordinary dividend of 15% (same); forward, £128,605 (£126,940).

Thompson Bros. (Bilston)—Trading profit to July 31 last, after E.P.T., £56,251 (£59,146); interest received, £1,283 (nil); depreciation, £7,859 (£7,602); A.R.P., £7,172 (£7,749); war insurance, £2,329 (£3,090); income-tax, £21,116 (£21,711); 6% preference dividend, £624 (same); ordinary interim dividend of 7½% (same), £3,360; final dividend of 7½% (same), plus bonus of 7½% (same), £6,720; reserve, £10,000 (£15,000); forward, £14,682 (£16,652).

Crittall Manufacturing—Trading profit to August 31 last, after E.P.T., £398,608 (£428,195 after N.D.C.); debenture interest, £36,776 (£37,042); A.R.P. and depreciation, £54,600 (£53,376); income-tax, £158,518 (£177,293); net profit, £147,214 (£158,984); war damage insurance, £4,618 (£5,750); debenture redemption reserve £9,208 (£20,000); extension of pension scheme, nil (£12,500); contingencies and future taxation, £60,000 (£50,000); ordinary dividend of 20% (same); forward, £40,805 (£38,439).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Oliver Gibson & Sons, L. & N.E. Railway Yard, Railway Street, Leeds—Iron and brass founders. £3,000. F. O. and A. E. Gibson.

Welding Shields, 126, Clarendon Road, Hyde, Ches.—Manufacturers of welding equipment, etc. £200. H. Dean, J. Strong and R. Whipp.

Whitchurch (Glam) Engineering Company, Midland Bank Chambers, 97-100, Bute Street, Cardiff—£1,000. T. F. Dixon and E. V. C. Nicholls.

Dands & Parkes, 37, Temple Street, Birmingham, 2—Tool manufacturers, founders, engineers, etc. £1,000. L. Worsley-Dands and J. Parkes.

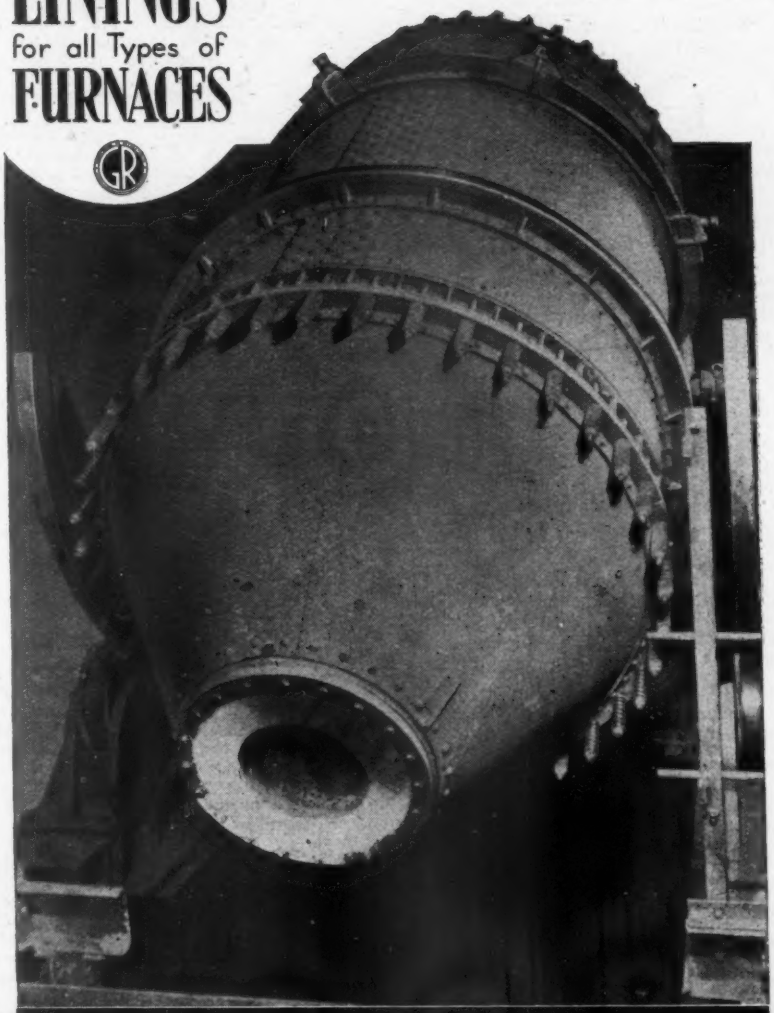
Wharton & Olding, 19, Fenchurch Street, London, E.C.—Engineers, tool makers, etc. £10,000. W. and J. Wharton, J. D. Olding, and A. Wilcock.

W. A. Bennett, B.S.C. Works, West Bromwich Street, Oldbury, Worcs—Iron, steel and black-plate merchants. £2,500. D. W. and E. J. Orchard, and W. A. Bennett.

Stenners of Tiverton, Lowman Ironworks, Tiverton, Devon—Woodworking machinery makers and engineers. £20,000. F. Johnstone, D. T. Morgan, W. P. Authers, and J. and F. S. Stenner.

Adamson-Horsehay Associated—Manufacturers and repairers of and dealers in iron and steel roofs, girders, machinery, chemical plant, etc. £1,000. G. R. and J. Adamson, J. C. Bignell, H. E. Colesworthy, A. V. Flinn, J. W. Hodgson, T. L. Massey, J., H., and A. H. Simpson. A. J. Corbett, 25, Oakfield Road, Selly Park, Birmingham, 29, subscriber.

LININGS
for all Types of
FURNACES



General Refractories Ltd
Head Office: Genefax House, Sheffield, 10. Telephone: 31113 (6 lines)

174

Raw Material Markets

IRON AND STEEL

Orders for light castings and also for certain types of engineering castings have undergone a marked shrinkage of late, and the outlook for some of the foundries has become so discouraging that they are not taking up their full quotas of iron. Thus, although the production of high-phosphorus iron has been curtailed, stocks are accumulating. On the other hand, establishments producing marine engineering and other special castings are fully employed and are still using big tonnages of low- and medium-phosphorus and refined iron. The supply of these grades and also of basic iron for steel furnaces keeps pace with the demand and only hematite iron is really scarce, the use of this grade being sanctioned only if other types of iron are totally unsuitable.

There is no difficulty with regard to supplies of coke. Ample quantities of furnace and foundry grades are available for current needs, and supplies of limestone and cupola ganister also are adequate. Supplies of scrap are forthcoming fairly readily on the whole. Some of the steelworks would like to receive more offers of heavy steel scrap, as recently they have had to draw to some extent on their reserves. Foundry scrap is adequate to requirements, but good cast-iron machinery scrap is by no means plentiful and generally has a ready sale. Short, heavy, steel scrap for foundries and for refined pig-iron making is only in moderate supply.

The use of bar iron has of late been widely extended. It is difficult to get early deliveries of steel bars and many users are ordering iron bars instead. This has given a marked impetus to the finished-iron trade and substantial orders are in hand for the next two or three months.

Re-rollers have entered into very heavy commitments for the production of light structural sections, small bars, sheets, etc., and execution of their programmes is dependent upon the maintenance of a steady flow of steel semis. In this respect the steel industry has more nearly approached a state of self-sufficiency than at any previous period of the war. Steelmakers have increased their deliveries of prime billets, blooms and sheet bars. Considerable quantities of defectives, crops, etc., are being used, and quite rarely now is it necessary to encroach upon the reserve stocks of imported material.

The shipbuilding industry now ranks as the principal consumer of steel plates, sheets, etc.; but in other industries also a very substantial demand has developed and bookings already extend into the second period of 1944. While the plate mills have the heaviest order-books, however, there is also an active demand for all but the heaviest sectional materials. The aggregate distribution of steel props, roofing bars, arches, rails and chairs tends steadily to increase. Activity in the tube works, rivet, nut, and bolt and wire-drawing establishments is kept at a high level.

NON-FERROUS METALS

According to statistics recently released, total supplies of tin available in the United States at the present time amount to some 100,000 tons. Here in Britain, also, it is believed that a substantial tonnage of tin is held in reserve. That the stock position should be relatively so favourable after four years of war is gratifying, to say the least. It is appreciated, of course, that these stocks would quickly evaporate were they allowed to be distributed indiscriminately. As it is, they represent an emergency reserve which ensures that supplies will continue to be forthcoming for essential purposes for a long time yet. Bolivia, Nigeria and the Congo are supplying us with tin in increasing quantities, but these areas cannot make up for the production of Malaya and the Netherlands East Indies, which are unfortunately now in the hands of the Japanese. In the circumstances, the utmost economy in the use of the metal is essential in the interests of the war effort. Supplies of copper, lead and spelter continue to be readily forthcoming against licences to acquire metal, and no difficulty is expected throughout the remainder of the war period.

CONTROL OF MEASURING INSTRUMENTS

The issue of a new Control Order (the Control of Machine Tools (Measuring Instruments and Machines) (No. 1) Order, 1943), operative on and from December 1, is announced by the Ministry of Supply, Machine Tool Control. The Order makes it illegal for any person to acquire any new measuring instrument or machine specified in the Schedule to the Order unless he is the holder of a licence issued by the Minister of Supply. The Order also makes it illegal, in the absence of a special or general direction, for anybody to dispose of new apparatus of the types specified except to the holder of a licence. The measuring instruments and machines concerned are of the more expensive types used in engineering workshops and test rooms, for measuring engineering components, or for testing the mechanical properties of engineering materials.

Persons or firms requiring any of the specified instruments or machines should consult a copy of the Order (obtainable from H.M. Stationery Office) and apply for the necessary licence by forwarding an Application Form 5C 1 to the Controller of Jigs, Tools and Gauges, acting on behalf of the Minister of Supply, at 35, Old Queen Street, London, S.W.1. Apparatus required for export will also need a licence, obtainable by similar procedure.

The Ministry of Supply also announces that since the Control of Machine Tools (No. 13) Order came into effect on April 12, 1943, it has been decided to eliminate Items A, B and C in Direction No. 1 of the No. 13 Order. The practical effect is that all baling presses will be under the control of the Board of Trade.

FOUNDRY

EST. 1902 TRADE JOURNAL

VOL. 71. No. 1421. WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Registered at the G.P.O. as a Newspaper. DECEMBER 9, 1943 Offices: 49, Wellington Street, Strand, London, W.C.2

Single Copy 6d. [By Post 8d. Annual Subscription, Home and Overseas, 21/- (Post

PIG IRONS

FOR ALL PURPOSES

PRIESTMAN

FOUNDRY COKES

"LEEFRA" REFRACTORIES

MANSFIELD MOULDING SAND

GANISTER · LIMESTONE · SEA SAND

CORE OILS · FOUNDRY BRUSHES & SUPPLIES

THOS. W. WARD LTD.

ALBION WORKS · SHEFFIELD

TELEPHONE : 26311 (18 Lines)

TELEGRAMS : "FORWARD, SHEFFIELD"